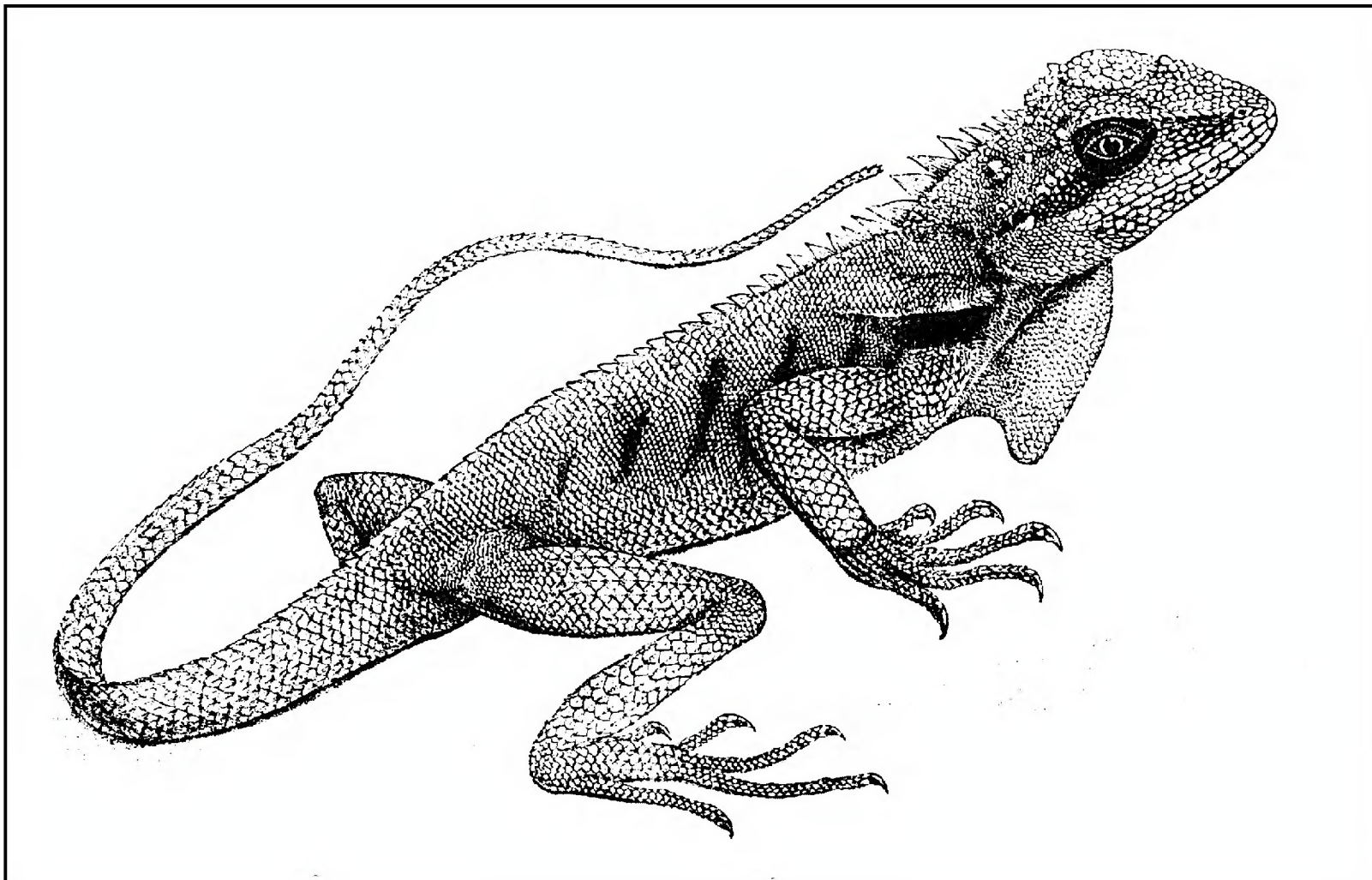

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BULLETIN OF THE CHICAGO HERPETOLOGICAL SOCIETY

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A Flawed USGS Report on Giant Constrictors

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The basis for the action to place the great constrictors and the boa constrictor on the Injurious Wildlife List of the Lacey Act is a report issued by the United States Geological Survey (USGS) titled *Giant Constrictors: Biological and Management Profiles and an Establishment Risk assessment for Nine Large Species of Pythons, Anacondas, and the Boa Constrictor*. This 302-page report was authored by Robert N. Reed and Gordon H. Rodda, biologists employed by the Invasive Species Programs of the USGS; it was issued in December 2009.

The report has been touted as the scientific foundation supporting the controversial hypothesis that the eight large constrictor species and boa constrictor might establish in the continental United States outside of South Florida to become undesirable and invasive exotic wildlife. However, the recent cold weather of the first two weeks of 2010 in the American Southeast and particularly in Florida has illustrated a serious flaw in a fundamental assumption made by the authors, an assumption on which all of the science in the report is based.

Most simply stated, the USGS report is wrong. The report grossly exaggerates the areas in the USA identified as suitable climate for each of the nine species. None of the species can survive in nature in the U.S. mainland outside of the Everglades region of South Florida. The above-mentioned Florida cold snap and the resulting python deaths call into question whether even Burmese pythons are permanently established in the Everglades region.

A Freezing Dose of Reality

During the first two weeks of 2010 an arctic front crashed into the southeastern United States with a cold fury. Temperatures throughout most of Florida were well below freezing. In South Florida, the cold took most of the citrus crop, crashed the tropical fish industry, and badly damaged tilapia aquaculture. Palms and cycads died from the cold. Coral reefs died in shallow Florida Bay. Dozens of manatees and American crocodiles died. Iguanas fell frozen from the trees. During January 2–13, South Florida was colder than it had been in decades. This was a perfect test of the conclusions of the USGS report.

But this was by no means the only cold weather ever to hit Florida. This was not a fluke. Based on data from the National Weather Service, this is a fairly regular occurrence. During the January freeze, Miami experienced an official low temperature of 35°F, but it was just as cold in 1970, and even colder on three previous dates, dating back to 1898. In south Dade County, it was 26°F at the Tamiami Airport on January 11, but it had been that cold there before, in 1940.

West Palm Beach and Naples set records with 10 consecutive days under 45°. Miami and Fort Lauderdale had 10 consecutive days with temperatures below 50°, but the historic record stretch is 13 days. Throughout South Florida, this was the longest uninterrupted period of cold weather since 1940, but in Miami only two records for daily low temperatures were set in that

period. Record lows for each date of the first two weeks of January were set in 1898, 1903, 1918, 1919, 1927, 1970, 1981, 1982 and 1997. There are other periods of extreme cold in December and in February scattered back through time. South Florida may be the warmest winter spot in the continental United States, but it gets cold on a fairly regular basis.

It took this hard freeze in Florida to drive home the truth that biologists, keepers, and herpetologists have been stating over and over—the nine species cannot survive in the continental USA. Perhaps the Everglades region is the exception, but elsewhere it's too cold. There is no adequate shelter. The snakes do not have the necessary instincts and behaviors necessary to survive fatal cold.

The Burmese pythons in South Florida froze, and Burmese pythons are the most cold-tolerant of all the nine species. They didn't all freeze; some survived. But if they died in the Everglades at 35°F, there is justifiable skepticism that, as predicted in this USGS report, they could survive in Oklahoma—where it was 5°F with two feet of snow. Even in South Texas, during the January cold spell, the days were 35° and the nights got down to the teens for over a week—those are fatal temperatures for every one of the nine species.

None of the nine species featured in the USGS report will establish in nature in the U.S. mainland outside of the Everglades region, contrary to the conclusion of the report. This statement is not a hypothesis or a prediction; it is based on hard fact. The following close examination of the USGS report reveals just how its alarming and erroneous conclusions were reached.

The Taxon Accounts

The USGS report consists of three main parts. The first part, by far the largest, is comprised of the taxon accounts created for each of the nine species. The authors state: “The core of this work—the biological profiles—are a work of traditional library scholarship. . . .” The chapters largely devoted to reviews of the taxa comprise 202 pages of the 260 pages of text, tables and figures in the report. Chapter 3 also is primarily a literature review—of eradication tools and methods that could be used in the efforts to control or exterminate any of the great constrictor species discovered in incipient populations.

This bulk of the report is based on the References Cited. This part of the report is not itself scientific in nature; as a review and summary, it presents little, if any, original data or insights into the biology of each of the species. None of the herpetological references that comprise the literature search contain data or arguments that would indicate or warn of any potential of large constrictors to colonize the continental USA.

Climate Space and Climate Matching

The second major component of the report is an attempt to quantify the climate in which each species lives in nature, and

then identify areas in the USA with similar climatic characteristics.

In Section 3 of each taxon account, the “climate space” of each species is calculated. Climate space is described to be the combination of conditions under which each taxon survives in nature. The calculation used in this paper is identified as a bivariate characterization of the climate where a species is found. The two variables used to characterize climate space are mean monthly temperature and mean monthly precipitation.

Herein lies the fundamental error of the report. The authors chose to use the “mean monthly temperature” as the unit of temperature used to define climate space. The point was to find the lowest temperature at which these species can survive. Maximum mean temperature is not a particular concern, since all of these animals come from areas with predominantly warmer mean monthly temperatures than the continental USA.

The authors chose the lowest monthly mean temperature within the natural range of each species and treated it as if it were the critical minimum temperature. In fact, they acknowledge that the actual minimum temperatures disguised within their winter average temperatures might be too low. Reed and Rodda state: “We chose mean monthly precipitation and mean monthly temperature as adequately representing the climate attributes best associated with giant constrictor range limitations.” They go on to defend their choice of monthly mean temperatures, saying: “We do not believe that daily values [temperatures] are appropriate for snakes that have access to natural refugia, as the low metabolic demands of reptilian physiology, as well as the huge meals eaten by giant constrictors, insures that they do not need to venture out every day or even every week in order to maintain a net positive energy balance.”

In other words, they predict that daily low temperatures are not important—they predict that the nine species have the necessary physiological adaptations, behaviors, and instincts to successfully shelter during inclement weather. This is an a priori assumption of the authors that is incorrect. They do not offer any suggestion as to where or in what a population of 100-pound snakes might find suitable shelter from winter cold in any area of the southern USA.

They chose wrong. Temperatures in the tropical areas that are home to these animals are far less variable than in the significantly more seasonal continental USA. A mean monthly temperature of 55°F can be a month of daytime highs of 56° and nights of 54°; it also can be 20 days with high temperatures of 70° and nighttime lows of 60, and 10 days of 40° highs and 30° nights, similar to what happened during the first two weeks of January 2010 in Florida.

Using monthly mean temperatures from the natural ranges of the nine species to estimate climate space serves to mask deleterious minimum temperatures when superimposed over the monthly mean temperatures of the far more seasonal and variable climate of the USA.

The choice to use mean monthly temperatures as the variable in determining the climate space obscured critically low temperatures. The climate space estimated in each taxon account,

when matched to current U.S. climate, consequently included areas actually subject to far cooler extremes than occur in the natural range. When this incorrectly calculated climate space was matched to the current U.S. climate, the resulting maps showing the areas of suitable climate in the USA were grossly exaggerated.

The authors do not include the weather data on which their climate space predictions are based. They do not cite what temperatures they arbitrarily chose as the lowest acceptable monthly mean temperatures for each species.

Most of the climate data used for seven species are not even based on actual weather reporting stations. Instead the authors used “climate estimates” provided by the WorldClim data base (Hijmans et al., 2005).

As in the previous “Burmese map paper” (Rodda et al., 2009), the authors do not reveal the geographic locations and elevations from which data are derived and on which their climate space estimations are based. That is particularly relevant to this report and the discourse it has generated, as further examinations of weather data from those stations would show exactly what minimum daily temperatures exactly had been recorded at each reporting station, and what was the range of the reported monthly mean temperatures over the period of years from which they had been reported.

The reporting stations that supplied data used in determining the climate spaces of the nine species are described as being located, when possible, close to a specific locality where a species is reported to occur, and matched to the exact elevation. The key words here are “when possible.”

In the Case of the Burmese Python

A recently published paper recognizes the Burmese python as a full species, *Python bivittatus*, with two subspecies, *P. b. bivittatus* and *P. b. progschai* (Jacobs et al., 2009). One of the co-authors of that paper, Mark Auliya, is mentioned in the acknowledgments of Reed and Rodda (2009) as having provided “valuable unpublished data.” Apparently Auliya didn’t mention that he was elevating *bivittatus* to species rank, because Rodda et al. (2009) state (without giving reasons) that the Burmese python is “a questionable subspecies.”

As a result of their assumption about the questionable validity of the taxon, the authors chose to treat the Burmese python as the Asian python, *Python molurus*, lumping it with its former conspecific and ignoring the fact that it is only the Burmese python that is of any concern in the matter of established exotic species in the USA. Of course the effect of this was to increase the estimated climate space of the species, and thereby significantly increase the area in the continental USA predicted to be suitable climate.

The climate space graph for the Asian python, *Python molurus*, in this report is based on the data from 149 weather reporting stations, as reported in Rodda et al. (2009). In fact, no such data is provided in this USGS report for any of the species—however, we are able to make this assumption about the source of data for the Asian python account in this report because the

graph and map in this report are copied from that previous paper.

That being the case, of the 149 tallied, 43 stations, 28.8% percent, are in China at the northern extent of the range of the species, even though the Chinese range of the species constitutes a significantly smaller percentage of the total range of the species. Additionally an unspecified number of reporting stations can be assumed to be located in Assam, Bhutan, Nepal, northern Myanmar, and northern India—the most northerly and cool portions of the range of the Asian python—to further emphasize the coolest areas in which the species is known to occur.

Further, we are not aware of 43 different published Chinese localities for Burmese pythons. The few published localities of which we have record are mostly not exact and very few have elevation data. That presents the likelihood that the authors have arbitrarily chosen some of the weather stations and also the elevations of those localities. The criteria used to make these choices are not specified in this report.

The authors have chosen to discount the fact that none of the Burmese pythons imported into the USA have been collected from the northern portion of the range (Barker and Barker, 2008). Additionally, none of the countries at the northern extremes of the range allow exports of pythons, so no Burmese from northern populations are likely to enter this country.

Based on scattered anecdotal accounts in the literature, the authors accept the premise that Burmese pythons “hibernate.” Rodda et al (2009) and this report both cite Minton (1966) as the main reference for hibernation of the Asian python. However, close examination of that reference shows that Minton (1) was referring only to his area of study at the extreme eastern limit of the range of the species; (2) only the Indian python, *Python molurus molurus*, was referenced—no mention is made of the natural history of the Burmese python; (3) most or all of the information regarding natural history is based on stories told to Minton by local collectors and professional snake collectors, and as such must be regarded as second-hand and anecdotal; (4) Minton never mentions pythons undergoing “hibernation,” stating only that pythons are “largely torpid” for the winter months; (5) the sole use of the word “hibernation” in the python account of Minton (1966) is a quote from Smith (1943) who is, in turn, citing Walls (1912), to say that in northern India pythons mate during hibernation. Generally speaking, animals do not mate if they are in a true state of hibernation; the state of seasonal quiescence referred to as hibernation by the authors would be more correctly identified as brumation or dormancy. None of the nine species in this report hibernate, despite the conjecture of the authors to the contrary.

Certainly there are a few records of Burmese pythons at the northern periphery of the range at elevations exceeding 1000 m where in order to survive, they might be expected to brumate. In these cases, we would suggest that there is an unexplored possibility that the species might seasonally migrate to lower elevations and more temperate conditions. This possibility is supported by observations of Burmese pythons in the Everglades that have been radio-tracked moving distances exceeding 50 miles in the space of a few months (Harvey et al., 2008).

It’s also possible that small populations of Burmese pythons at the northernmost limits of their range have evolved metabolic adaptations and behaviors that allow them to survive exceptional low temperatures.

However, beyond those conjectures, what has been clearly demonstrated is that Burmese pythons in cold conditions in the USA have not shown any particular cold-hardiness or any behavior to protect themselves from cold extremes (Barker, 2008). This fact was particularly well illustrated by the extreme die-off of almost all Burmese pythons that were radio-monitored and in outdoor enclosures in Florida as a result of the cold weather of the first two weeks of January 2010.

It would be a gross mistake to assume that a Burmese python can survive anywhere in the continental USA except possibly in the Everglades region. Even that is currently uncertain.

The Establishment Risk Assessment

The third part major part of this report is the establishment risk assessments created for the nine species, found in Chapter 10 of the report. This is done following the guidance established by the Aquatic Nuisance Species Task Force (ANSTF, 1996).

The risk assessment is comprised of two parts. In the first part there are four factors that together evaluate the risk of establishment. The second part considers three factors to evaluate the consequences of establishment.

The authors provide a section to discuss each of the factors and provide their arguments for scoring each species as they have. A table summarizes and illustrates the choices made for the components of each of the factors.

It is our observation that the entire process of creating the risk assessments in this report is fatuous because of the lack of quantifiable and objective data that is required by the process.

In the absence of data required by the process to create the risk analyses, the authors exercise their apparent a priori assumption that all nine species in fact do pose a threat of colonizing areas of the continental USA. In some cases the authors have left blank some of the components rather than provide answers that would be deleterious to their argument; in others they have chosen answers that are based on their a priori assumptions, and on their biased opinions of the issue. Many of their choices that form the bases of the risk assessments are open to argument; there are several that are, in our opinion, clearly incorrect.

However, it is not necessary to review the tables line-by-line. The fact now established that the climate matching performed in this report is incorrect and false makes moot any argument that these species pose any quantifiable risk.

Climate matching has been identified as one of the most important factors to predict the invasive potential of exotic reptiles and amphibians (Bomford et al., 2009). In this case, there is no climate match and there is no potential of any of these nine species existing anywhere in the U.S. mainland except possibly the Everglades region of South Florida.

In Conclusion

The USGS report is invalid for many reasons (Barker and Barker, 2010). However, it took the Florida freeze of January 2010 to show just how unrealistic are the climate matches illustrated with the attractive multi-colored maps. There is now a

conclusive answer to the question posed in the title of the paper by Rodda et al. (2009), “What parts of the US mainland are climatically suitable for invasive alien pythons spreading from Everglades National Park?” The answer is “none.”

References Cited

- ANSTF. 1996. Generic nonindigenous aquatic organisms risk analysis review process (for estimating risk associated with the introduction of nonindigenous aquatic organisms and how to manage for that risk). Washington, D.C.: Aquatic Nuisance Species Task Force.
- Barker, D. G. 2008. Will they come in out of the cold? Observations of large constrictors in cool and cold conditions. *Bull. Chicago Herp. Soc.* 43(6):93-97.
- Barker, D. G., and T. M. Barker. 2008. The distribution of the Burmese python, *Python molurus bivittatus*. *Bull. Chicago Herp. Soc.* 43(3):33-38.
- Barker, D. G., and T. M. Barker. 2010. Review: Giant Constrictors: *Biological and Management Profiles and an Establishment Risk Assessment for Nine Large Species of Pythons, Anacondas, and the Boa Constrictor* by Robert Reed and Gordon Rodda. *Bull. Chicago Herp. Soc.* 45(1):10-17.
- Bomford, M., F. Kraus, S. C. Barry, and E. Lawrence. 2009. Predicting establishment success for alien reptiles and amphibians: A role for climate matching. *Biological Invasions* 11:713-724.
- Harvey, R. G., M. L. Brien, S. Cherkiss, M. Dorcas, M. Rochford, R. W. Snow and F. J. Mazzotti. 2008 [reviewed 2009]. Burmese pythons in South Florida: Scientific support for invasive species management. Wildlife, Ecology and Conservation Department, Florida Cooperative Extension Service [WEC42]:1-11.
- Hijmans, R. J., S. E. Cameron, J. L. Parra, P. G. Jones and A. Jarvis. 2005. Very high resolution interpolated climate surfaces for global land areas. *International Journal of Climatology* 25:1965-1978.
- Jacobs, H. J., M. Auliya and W. Böhme. 2009. Zur Taxonomie des Dunklen Tigerpythons, *Python molurus bivittatus* Kuhl, 1820, speziell der Population von Sulawesi. *Sauria* 31(3):5-16.
- Minton, S. A., Jr. 1966. A contribution to the herpetology of West Pakistan. *Bulletin of the American Museum of Natural History* 134:29-184.
- Reed, R. N., and G. H. Rodda. 2009. Giant constrictors: biological and management profiles and an establishment risk assessment for nine large species of pythons, anacondas, and the boa constrictor. U.S. Geological Survey Open-File Report 2009-1202.
- Rodda, G. H., C. S. Jarnevich and R. N. Reed. 2009. What parts of the US mainland are climatically suitable for invasive alien pythons spreading from Everglades National Park? *Biological Invasions* 11:241-252. [Published online: 27 February 2008]
- Smith, M. A. 1943. The fauna of British India including Ceylon and Burma. Reptilia and Amphibia. Vol. III—Serpentes. London: Taylor and Francis.
- Wall, F. 1912. A treatise on the common Indian snakes. *Journal of the Bombay Natural History Society* 21:447-476.

Minimum Habitat Requirements of the Copper-bellied Watersnake (*Nerodia erythrogaster neglecta*)

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Introduction

The copper-bellied watersnake (*Nerodia erythrogaster neglecta*) is the northern subspecies of the plain-bellied watersnake (*Nerodia erythrogaster*). *Nerodia e. neglecta* is known to utilize a much larger area compared to other semi-aquatic snake species (Roe et al., 2004, 2006; Laurent and Kingsbury, 2003). Ideal habitat for this snake consists of a wetland complex encompassing several hundred acres (U.S. Fish and Wildlife Service, 2008). To sustain a population of this species, a wetland complex must include several critical landscape features.

Human activities have resulted in wetland fragmentation, leading to loss of habitat and population declines. Anthropogenic factors that negatively impact habitat include wetland drainage, road systems, infrastructure and land development. It is estimated that up to 90% of postglacial wetlands have been destroyed in some areas of the Midwest (Roe et al., 2003). *Nerodia e. neglecta* is federally Threatened and currently listed as State Endangered in Indiana, Michigan and Ohio. It has special protected status in Illinois and Kentucky. Identifying and quantifying specific elements that are essential to sustaining populations of this subspecies is a difficult process. However, understanding the behavioral characteristics of *N. e. neglecta* provides insight into the landscape features that contribute to a stable breeding population. Minimum habitat standards can be determined, but site specific conditions should always be considered.

Hibernation

Hibernation behavior of *N. e. neglecta* provides evidence that wetlands and surrounding uplands are equally important factors in maintaining stable populations. One study found that almost all snakes utilized hibernation sites within or immediately adjacent to wetlands used during the active period (Kingsbury and Coppola, 2000). Snakes selected wetland hibernation sites despite the availability of upland locations < 20 m away. The researchers found that preferred sites are abandoned crayfish burrows or rotten stumps slightly above the floodplain. Sites were so close to the high water mark that during hibernation several burrows filled almost entirely with water. This caused snakes to move their heads out of the burrows to avoid drowning. Many snakes were also found to use sites in the same locality between years.

Research conducted at another wetland complex inhabited by *N. e. neglecta* provided conflicting data. The authors found that 93% of snakes hibernated in upland locations (Roe et al., 2003). Mean distance from the nearest wetland to hibernacula was determined to be 53.5 m. One snake overwintered at a site 145 m from the nearest wetland; this was the site furthest from water.

The results of the above-referenced studies suggest that *N. e. neglecta* utilizes both upland and wetland hibernation sites. Hibernation site distance from wetland borders can be used as an important measure to determine appropriate buffer zones.

Research areas utilized in these conflicting studies had unique characteristics, but both provided adequate wetland and upland hibernation locations. Factors that caused snakes to choose either upland or wetland sites were not apparent. Further research into site selection would be beneficial for determining buffer distances.

One recommendation for hibernation habitat is that soil surrounding wetlands should be saturated, but not flooded, at depths of 15 to 64 cm below the soil surface (USDA-NRCS, 2007). Additionally, logs and debris should be present along wetland edges. These conditions promote crayfish abundance. A recommendation for the wetland buffer zone is to protect an area extending to the second topographic contour line above the NWI border up to a maximum distance of 50 m (Kingsbury and Coppola, 2000). This may be an appropriate minimum, but there are data suggesting that this distance should be extended. Further research into hibernation behavior is needed due to contrasting results in the current literature.

Feeding Patterns

Nerodia e. neglecta is a specialist predator that travels long distances in order to reach ephemeral wetlands. These wetlands are typically inhabited by an abundance of anurans, which are the preferred prey. In some parts of the northern range, this species is considered to be an extreme specialist on short-lived frogs and toads in both larval and adult forms (Laurent and Kingsbury, 2003; Roe et al., 2004). In other areas, fish and crayfish are a larger part of the diet. One study found that larval and adult anurans provided 97% of food requirements. The other 3% consisted of crayfish. Anuran species regularly consumed were identified as *Bufo americanus*, *Rana catesbeiana*, *Rana pipiens* and *Rana sylvatica*. Two of these species, *Bufo americanus* and *Rana sylvatica*, typically reproduce in shallow or temporary wetlands. This presents a problem for *N. e. neglecta* because ephemeral wetlands are variable between years. Variability is due to precipitation levels and other ecological factors. One or more wetlands within a complex may not establish to produce tadpoles and frogs every year. Having several, geographically isolated ephemeral wetlands within a complex is beneficial due to variation in productivity.

Nerodia e. neglecta may have become an anuran specialist due to the evolutionary process of resource partitioning. This may be the underlying factor behind the long distance travels to ephemeral wetlands (Laurent and Kingsbury, 2003). Other semi-aquatic snakes in the genus *Nerodia* maintain a diet that relies upon fish. Fish are typically more available as a food source in deeper wetlands. One species found within the range of *N. e. neglecta*, the northern watersnake (*Nerodia sipedon*), exhibits this type of behavior (Attum et al., 2007). Adaptation to a different niche makes it difficult for *N. e. neglecta* to survive in deeper, more permanent wetland habitats.

A major problem with regard to conservation of *N. e. neglecta*

ta is that ephemeral wetlands are often not recognized and may be overlooked by current regulations. When wetlands are recognized and mitigation occurs, it often results in construction of larger and deeper consolidated wetlands. These deep-water wetlands provide little or no habitat for valuable species of anurans. This type of mitigation typically increases travel distances. It reduces populations of *N. e. neglecta* and gives species such as *N. sipedon* a competitive advantage.

Mating

One study found that mating typically occurs in water depths of < 15 cm (Lacki et al., 2005). The authors found that cover types used for mating include flooded forests and ponds. An important observation made by the researchers was that snakes used a constructed pond for mating. This is evidence that mitigation can be effective in some cases. Mating has been found to occur in close proximity to woody debris near shore. The debris may serve as escape cover. Debris piles also provide basking sites for snakes throughout the active period. Male *N. e. neglecta* have been observed traveling longer distances than females, especially early in the active period (Roe et al., 2004). This behavior is probably a result of males searching for mates throughout the wetland complex (U.S. Fish and Wildlife Service, 2008).

Movement and Territory

Research has determined that one major cause of movement is seasonal drying of wetlands (Laurent and Kingsbury, 2003). Seasonal drying causes smaller wetlands to disappear and decreases the size of previously larger wetlands making them more desirable. Another factor that can effect movements is destruction of wetlands. The major difference is that seasonally dry wetlands become useful during wet periods whereas destruction results in a permanent loss of habitat. Permanent loss of wetlands has been linked to longer travel distances and reduced availability of resources (Roe et al., 2003). Longer journeys often result in higher predation levels and more deaths due to increased encounters with humans. This causes severe stress on *N. e. neglecta* populations. If distances between wetlands become too great, geographic isolation can occur. This may cause critical foraging sites to become unreachable and can alter meta-population dynamics. Eventually, survival and fitness can be negatively affected causing loss of populations (Roe et al., 2003).

Nerodia e. neglecta travels an average of 53.3 m per day (Roe et al., 2004). This is more than twice the distance of 25.6 m that *Nerodia sipedon*, a related species, typically travels. In a two-year study male and female *N. e. neglecta* traveled to an average of 4.1 individual wetlands, shifted between wetlands 9.1 times and moved a mean distance of 143.1 m between wetlands in a single complex during the summer active period (Roe et al., 2003). In the same study, 95% of *N. e. neglecta* were found to never travel a distance > 125 m in any direction from the nearest wetland. Furthermore, 100% were found to be within 175 m of the nearest wetland. These distances should be taken into consideration when determining the suitability of a wetland complex. Further research into movement patterns will allow for more accurate determinations.

Travel Corridors and Roads

Upland corridors must be available and must be designed to limit mortality to allow for *N. e. neglecta* to travel between wetlands within a complex. One study found that the most frequently used travel routes consisted of herbaceous and grass/sedge cover types (Laurent and Kingsbury, 2003). It is recommended that a combination of trees, shrubs and grasses be present in a corridor (USDA-NRCS, 2007). Native plant species are ideal due to co-evolution with native fauna. Corridors should be a minimum of 30.5 m wide, with a minimum width to length ratio of 1:5. Corridors must provide a travel route between wetlands, which should be separated by a distance of < 200 m. This has been suggested to be the maximum distance *N. e. neglecta* will travel between independent wetlands. This distance is an area for further research, but at a maximum no wetland should be > 200 m from any single point on the travel corridor. Corridors must not only be available, but they must be barrier free.

The presence of roads is a major cause of mortality for *N. e. neglecta* during movements. Roe et al. (2006) estimated that 14 to 21% of all mortality is caused by road crossings. Up to 60% mortality is probable in populations that regularly cross heavily trafficked roads. Additionally, 91% of road crossing deaths occur when snakes are moving between wetlands. This amount of mortality can have an impact on population demographics because *N. e. neglecta* is a comparatively long-lived snake, reaching maturity at 3 to 4 years. The result could be isolated populations, which could decrease genetic variability and lead to even lower numbers of this endangered species. One recommendation is that a 350 m terrestrial buffer is placed between wetlands and roads (Roe et al., 2006). Road density was found to be a major factor that increased mortality within a complex. Therefore if roads must be built, they should be consolidated and low volume. Seasonal closings should also be considered. Another possible solution to this problem is the use of road crossing structures. These gateways have proven to be effective in reducing mortality of snakes, turtles, salamanders and other wildlife (Andrews et al., 2008). Crossing structures proven to be effective usually consist of a barrier fence paired with an underpass. For herpetological use, the fence must be a non-penetrable material such as concrete or fine mesh. Underpasses can be tunnels or trenches below roads. They are typically concrete with adequate drainage and size for targeted species. Bridges can also be used to raise the road above critical habitat areas. Tunnels must be strategically placed and managed for moisture, hydrology, temperature and noise (Jackson, 2003).

Discussion

Based on the behavior and adaptations of *N. e. neglecta* a mixture of several permanent and ephemeral wetlands should be present within a wetland complex. One report stated that the minimum size for a single complex should be several hundred contiguous acres (U.S. Fish and Wildlife Service, 2008). Each individual wetland should not exceed a distance of 200 m from the nearest neighbor (USDA-NRCS, 2007). This distance of 200 m may need to be reduced in some areas, because one study found *N. e. neglecta* never traveled > 175 m from the nearest wetland. A minimum of four geographically isolated, seasonally

flooded wetlands should be present in the complex. This number is based on evidence that breeding populations typically utilize at least four wetlands and lower numbers of wetlands increase travel distances (Roe et al., 2003). Each wetland should be surveyed to determine anuran abundance. Wetlands should have low-slope edges and provide crayfish habitat. Standing water at a depth < 15 cm should be present to provide breeding habitat. Woody debris should be present along shorelines for basking and seclusion. Wetlands should be connected by corridors consisting of forested, herbaceous and grass/sedge cover types. Upland corridors are important because they are used for travel, estivating, foraging and shedding. The corridor should be a minimum of 30.5 m wide, with a minimum width to length ratio of 1:5. A minimum buffer zone of 350 m should be present between wetlands and the nearest road (Roe et al., 2006). Roads should be routed around wetland complexes when possible. When roads must be routed through a complex they should be limited in number, low volume or seasonally closed. Development of wildlife crossing structures, including underpasses and fences, should be considered and major travel corridors should be avoided. If major corridors are impossible to avoid, bridges should be constructed. A buffer should extend a minimum of 145 m in all directions around every wetland in a complex to provide hibernation habitat for snakes. Further research could be conducted to determine factors such as: minimum number and type of wetlands necessary to sustain populations; hibernation site distances from wetlands; effective road-to-travel-corridor buffer distances; minimum distances between wetlands; and effectiveness of

wildlife crossing structures.

The practice of destroying smaller wetlands for urban development and agriculture should be terminated within areas inhabited by *N. e. neglecta*. This will require recognition and implementation of new laws protecting ephemeral and other small wetlands. When mitigation is necessary it should not focus exclusively on creating large, deep-water wetlands. Small ephemeral wetlands should also be constructed. According to one source (USDA-NRCS, 2007), an ideal mitigation wetland complex would include one-third permanent water, one-third semi-permanent water and one-third wetland that is almost always dry by midsummer. Standing water depth should be < 0.3 m to limit fish populations that could prey on anuran eggs. Ideal size of wetlands is 0.1 to 2.5 acres. Wetland canopy should consist of 50% open water, 25% forest, 12.5% shrubs and 12.5% herbaceous cover types. Logs and woody debris should be present and shorelines should have the lowest possible slope. This will promote invertebrate abundance, provide basking sites and provide seclusion sites.

Nerodia e. neglecta has more requirements, inhabits a larger home range and is more susceptible to risk than most semi-aquatic snakes. Changing opinions on the importance of maintaining biodiversity may be the most challenging obstacle affecting the conservation of habitat for this species. Each population lives within a unique landscape and has slightly different habitat requirements. Future research will allow for more site-specific recommendations.

Literature Cited

- Andrews, K. M., J. W. Gibbons and D. M. Jochimsen. 2008. Ecological effects of roads on amphibians and reptiles: A literature review. Pp. 121-143. *In*: J. C. Mitchell, R. E. Jung Brown and B. Bartholomew, editors, Urban herpetology. Salt Lake City, Utah: SSAR Herpetological Conservation, Number 3.
- Attum, O., Y. M. Lee, J. H. Roe and B. A. Kingsbury. 2007. Upland-wetland linkages: Relationship of upland and wetland characteristics with watersnake abundance. *Journal of Zoology* 271(2):134-139.
- Jackson, S. 2003. Proposed design and considerations for use of amphibian and reptile tunnels in New England. Amherst: University of Massachusetts.. Downloaded from: http://www.umass.edu/nrec/pdf_files/herp_tunnels.pdf
- Kingsbury, B. A., and C. J. Coppola. 2000. Hibernacula of the copperbelly water snake (*Nerodia erythrogaster neglecta*) in southern Indiana and Kentucky. *Journal of Herpetology* 34(2):294-298.
- Lacki, M. J., J. W. Hummer and J. L. Fitzgerald. 2005. Population patterns of Copperbelly Water Snakes (*Nerodia erythrogaster neglecta*) in a riparian corridor impacted by mining and reclamation. *American Midland Naturalist* 153:357-369.
- Laurent, E. J., and B. A. Kingsbury. 2003. Habitat separation among three species of water snakes in northwestern Kentucky. *Journal of Herpetology* 37(2):229-235.
- Roe, J. H., J. K. Gibson and B. A. Kingsbury. 2006. Beyond the wetland border: Estimating the impact of roads for two species of water snakes. *Biological Conservation* 130:161-168.
- Roe, J. H., B. A. Kingsbury and N. R. Herbert. 2003. Wetland and upland use patterns in semi-aquatic snakes: Implications for wetland conservation. *Wetlands* 23(4):1003-1014.
- Roe, J. H., B. A. Kingsbury and N. R. Herbert. 2004. Comparative water snake ecology: Conservation of mobile animals that use temporally dynamic resources. *Biological Conservation* 118:79-89.
- USD.A-NRCS. 2007. Copperbelly water snake: Habitat restoration guidelines. Indiana (ver. 1.1): United States Department of Agriculture, Natural Resource Conservation Service, Biology Technical Note. Downloaded from: http://www.in.nrcs.usda.gov/intranet/TechnicalNotes/Copperbelly_Water_Snake_Habitat_Guidelines_TechNote.pdf
- U.S. Fish and Wildlife Service. 2008. Northern population segment of the copperbelly water snake (*Nerodia erythrogaster neglecta*) recovery plan. Fort Snelling, Minnesota. ix + 79 pp.

Note on the Testicular Cycle of the Gray Earth Snake, *Geophis brachycephalus* (Serpentes: Colubridae), from Costa Rica

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Abstract

A histological examination of *Geophis brachycephalus* testes from Costa Rica revealed a prolonged period of sperm formation (= spermiogenesis) encompassing all months sampled (March, May, August, September, October and November). All other mature representatives of the other sixteen species of snakes I examined from Costa Rica were also undergoing spermiogenesis suggesting prolonged periods of sperm formation might be typical for Costa Rican snakes. Examination of testes from additional snake species from Costa Rica are needed to test this hypothesis.

The gray earth snake, *Geophis brachycephalus* is known from the lowland, premontane and lower montane zones of Costa Rica and western Panama (Savage, 2002). There is information on the ovarian cycle of *G. brachycephalus* in Fitch (1970), Sasa (1993) and Solórzano (2004), but, to my knowledge, timing of events in the testicular cycle are unknown. The purpose of this note is to provide information on the testicular cycle of *G. brachycephalus* from a histological examination of museum specimens.

Ten *G. brachycephalus* males (mean snout-vent length [SVL] = 273.4 mm $\pm$ 29.0 SD, range = 221–304 mm from Costa Rica, were examined from the herpetology collection of the Natural History Museum of Los Angeles County (LACM), Los Angeles, California. Specimens collected by province and date are: Alajuela, LACM 151275 August 1984, LACM 151290 September 1966; Cartago LACM 151276 November 1966, LACM 151283, LACM 151284, LACM 151286 and LACM 151288 March 1959; Limón LACM 151279 November 1966; San José LACM 151278 May 1967, LACM 151287 October 1963.

The left testis was removed for histological examination. Testes were embedded in paraffin and histological sections were cut at 5 μ m. Sections were mounted on glass slides and stained with Harris' hematoxylin followed by eosin counterstain (Presnell and Schreibman, 1997). Slides were examined to determine the stage of the testicular cycle. Histology slides are deposited in LACM.

The only stage observed was spermiogenesis (= sperm formation) in which the seminiferous tubules are lined by sperma-

tozoa and/or clusters of metamorphosing spermatids. Monthly numbers of spermiogenic males (followed by sample size in parentheses) are: March (4), May (1), August (2), September (1), October (1), November (1). The smallest reproductively active male measured 221 mm SVL (LACM 151290) and was from September. Even though samples were not available from all months, the observation of spermiogenic males from most of the year suggests a prolonged, and perhaps, continuous spermiogenesis. Year-round breeding in snakes from some aseasonal equatorial regions was reported by Fitch (1982). Other snakes from Costa Rica undergoing spermiogenesis in all months examined include: *Dendrophidion vinitor*, *Drymobius margaritiferus*, *Erythrolamprus bizona*, *E. mimus*, *Hydromorphus concolor*, *Micrurus nigrocinctus*, *Ninia maculata* (see Goldberg, 2006a). To the above list should be added: *Mastigodryas melanolomus* (Goldberg, 2006b), *Geophis godmani* (Goldberg, 2007a), *Coniophanes fissidens* (Goldberg, 2007b), *Ninia sebae* (Goldberg, 2007c), *Chironius exoletus* (Goldberg 2007d), *Stenorrhina freminvillii* (Goldberg, 2007e), *Rhadinea decorata* (Goldberg, 2007f), *Leptodeira septentrionalis* (Goldberg, 2008a), *Xenodon rabdocephalus* (Goldberg, 2008b). At this point it appears that prolonged periods of sperm formation may be typical for Costa Rican snakes. Examination of additional snake species from Costa Rica are required before this hypothesis can be accepted.

Acknowledgments

I thank Christine Thacker (LACM) for permission to examine *G. brachycephalus*, which are part of the Costa Rica Expeditions (CRE) collection donated to LACM by Jay M. Savage in 1998.

Literature Cited

- Fitch, H. S. 1970. Reproductive cycles in lizards and snakes. Museum of Natural History, University of Kansas, Miscellaneous Publication No. 52:1-247.
- . 1982. Reproductive cycles in tropical Reptiles. Museum of Natural History, University of Kansas, Occasional Papers 96:1-53.
- Goldberg, S. R. 2006a. Note on the testicular cycle of the Costa Rica water snake, *Hydromorphus concolor* (Serpentes: Colubridae). Bulletin of the Maryland Herpetological Society 42:169-170.
- . 2006b. Reproductive cycle of the salmon-bellied racer, *Mastigodryas melanolomus* (Serpentes, Colubridae), from Costa Rica. Phyllomedusa 5(2):145-148.

- . 2007a. Note on the testicular cycle of Godman's earth snake, *Geophis godmani* (Serpentes: Colubridae) from Costa Rica. Bull. Chicago Herp. Soc. 42(1):7-8.
- . 2007b. *Coniophanes fissidens* (Brown Spotbelly). Reproduction. Herpetological Review 38:339.
- . 2007c. Reproduction in the redback coffee snake, *Ninia sebae* (Serpentes: Colubridae), from southern Mexico and Central America. Texas Journal of Science 59(4):311-316.
- . 2007d. Note on reproduction of whipsnakes, genus *Chironius* (Serpentes: Colubridae), from Costa Rica. Bull. Chicago Herp. Soc. 42(9):148-149.
- . 2007e. Note on the testicular cycle of the northern scorpion-eater, *Stenorrhina freminvillii* (Serpentes: Colubridae) from Central America. Bull. Chicago Herp. Soc. 42(6):90-91.
- . 2007f. Notes on reproduction of the adorned graceful brown snake, *Rhadinea decorata* (Serpentes, Colubridae), from Costa Rica. Phyllomedusa 6(2):151-153.
- . 2008a. Note on reproduction of the northern cat-eyed snake, *Leptodeira septentrionalis* (Serpentes: Colubridae) from Costa Rica. Bull. Chicago Herp. Soc. 43(11):175-176.
- . 2008b. Reproduction in the false fer-de-lance, *Xenodon rabdocephalus* (Serpentes: Colubridae) from Costa Rica. The Herpetological Bulletin 103:16-18.
- Presnell, J. K., and M. P. Schreibman. 1997. Humason's animal tissue techniques, fifth edition. Baltimore, Maryland: The Johns Hopkins University Press.
- Sasa, M. 1993. Distribution and reproduction of the gray earth snake *Geophis brachycephalus* (Serpentes: Colubridae) in Costa Rica. Revista de Biología Tropical 41(2):295-297.
- Savage, J. M. 2002. The amphibians and reptiles of Costa Rica: A herpetofauna between two continents, between two seas. Chicago: The University of Chicago Press.
- Solórzano, A. 2004. Snakes of Costa Rica: Distribution, taxonomy, and natural history. Santo Domingo de Heredia, Costa Rica: Instituto Nacional de Biodiversidad (InBio).

Bull. Chicago Herp. Soc. 45(2):33, 2010

Predation by a Green Heron (*Butorides virescens*) on a Greater Siren (*Siren lacertina*)

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Although wading birds are likely predators of greater sirens, (Petranka, 1998), few records specific to greater siren depredations are reported in the literature. On 21 April 2006, a green heron was observed perched on top of a hoop net that was set in a small open area in Dry Bay, a 5-ha fishless Carolina bay located on the Department of Energy's Savannah River Site in Aiken County, South Carolina, USA. The heron remained on top of the hoop net until approached and then flew off to a nearby tree. A heron, presumed to be the same one, had been observed on numerous occasions since the beginning of April 2007 at Dry Bay, but was never out in the open and never allowed me to get as close to it as it had on this occasion. When the hoop net was lifted out of the water, a dead male *S. lacertina* was found inside. The cause of death was determined to be a puncture wound located 65 mm anterior to the vent. The punc-

ture was located on the right aspect of the dorsum and directed through to the left side, although there was no apparent exit wound. The siren was returned to the laboratory and frozen to await being preserved. After the siren was preserved, it was measured to be about 511 mm in total length with a snout-vent length of 341 mm. Great blue herons are frequently seen at this fishless wetland and are also likely predators.

Salamanders were captured under scientific research permit 56-2003 from the South Carolina Department of Natural Resources. Funding for this research was provided by the National Science Foundation (Awards DEB-0242874 and DBI-0139572) and the Savannah River Ecology Laboratory under Financial Assistance Award DE-FC09-96SR18-546 between the University of Georgia and the U.S. Department of Energy.

Literature Cited

- Petranka, J. W. 1998. Salamanders of the United States and Canada. Washington, D.C.: Smithsonian Institution Press.

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What You Missed at the January Meeting

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Before I launch into my monthly rehash of the meeting, allow me to mention another way to follow some of the many activities of your society. For the past few months I have occasionally sent out an e-blast with a listing of news and events and some interesting tidbits. Well, I think they're interesting. It's strictly limited to herp stuff. If you haven't been receiving these and want to, first check that your spam filter is not blocking them. If we don't have your email address, email me at the above address and I'll add you to the list. If you don't want them and are really tired of deleting them every time you view your email, please allow me to delete your name. Just email me saying no, or reply to my emails with a no, and you'll never have to look at that garbage again. We want the CHS to be your society the way you want it.

A small group met before January's meeting over snacks at a local restaurant. It was a reunion of some of our more senior members in honor of our speaker Ray Pawley. I used the power of my position (?) and got myself invited. I'm not a senior member of the CHS, I'm just old, but for the nine years or so that I've been a member I must have heard that name a thousand times, and I was not going to miss an opportunity to talk with him. So, while chewing on my cheese quesadilla, I conversed with Ray Pawley, probably occupying more of his time than the others appreciated. Ray and his wife Hedda are gracious and interesting and fun. After only ten minutes, Ray had invited me to visit them in New Mexico. That shows he's a man of taste also.

The meeting started with the usual business of my attempting to get a few words into the constant gibes of disrespect hurled my direction simply because I was standing in front of the crowd. Our new sergeant-at-arms Dick Buchholz did his best to try and quell the multitudes, but I fear your society is just not ready to show its president the respect that I so richly deserve. After Josh the raffle man did his normal great job with the raffle, Dick Buchholz introduced Ray with a little history of the CHS.

Ray Pawley was the second president of your society and for the next six years he alternated in that position with Dick. Together, after two failed attempts by others and on an extremely limited budget, they built a society that finally had some staying power. Dick stressed the difficulties of trying to get a publication started and running an organization with almost nothing in the way of funds, and Ray mentioned how some wanted to keep the society for professionals while he and Dick argued for a broad-based group that allowed for amateur herpetologists as well as appealing to the professionals. Obviously Dick and Ray won and your society is the stronger for it. Dick



Ray Pawley begins his talk. Photograph by Bill Peterson.

and Ray gave just enough insight into the CHS's past to make me once again wish that we had someone who could write a full history.

Though this was his first talk in a long time, Ray Pawley has been one of the most frequent speakers at CHS meetings. He revealed his experience by opening with a quip that the recorder I had slipped into his pocket was electrically charged to deliver a

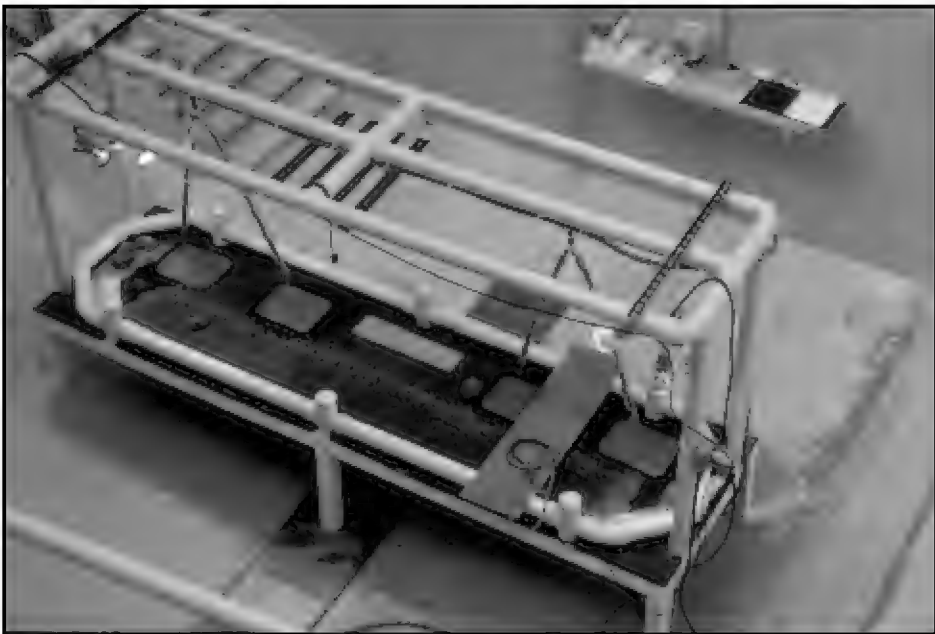
shock if he talked too long. There was no fear of that as the audience stayed to the very end of his question period. Ray started out as a zoologist hired by Marlin Perkins at the Lincoln Park Zoo, where his duties were primarily animal wrangling for Perkins's TV show *The Wild Kingdom*. After three years he moved to the Brookfield Zoo where he stayed for the next thirty-three years, many of those as curator of reptiles. He's now retired in New Mexico but still extensively involved with herps. He's got black-tails (*Crotalus molossus*) crawling through his yard! His presentation was titled "Raising Galapagos Tortoises without a Roadmap: A Learning Curve," and featured highlights of a paper that he hopes to publish soon. In the 1980s while at the Brookfield Zoo, Ray began to think about breeding Galapagos tortoises (*Geochelone nigra*). The Charles Darwin Research Station (CDRS) in the Galapagos had been very successful in line-breeding these tortoises, but Ray knew that zoos would eventually need more tortoises for education and those need not be line-bred. With a wealth of information from the CDRS and help from Greg Moss and Ramon Noegel of the Life Fellowship Bird Sanctuary in Florida, Ray shipped his one female to the Foundation where she mated with their males. At forty years of age, in spite of never having bred, she reproduced easily and soon Ray had days-old babies in his care. Within weeks all four were dead, all from twisted gut syndrome! Obviously there was much more to raising these creatures than the current literature revealed. Making the correct changes was imperative, and to Ray's credit, from 1990 to 1996 the zoo received thirty-one babies and lost only five, including the first four. The babies were much more aggressive towards each other than anyone expected, and Ray surmised that in fighting each other the babies were rolled over causing the gut problem. The keepers had learned their lesson and began raising tortoises.

Ray covered a little of everything involved with the Brookfield tortoises, giving us not only insights into the natural history and husbandry of the animals, but also a look into the thought processes behind the keepers' decisions and some challenges for future studies. His first slide was a sunrise over the rim of Alcedo volcano that led us into accounts of Ray's trips to the Galapagos and what he learned about the tortoises in the wild



The famous Lonesome George, last surviving member of his subspecies, taken in the Galapagos by Ray Pawley.

and at the CDRS. The Galapagos, with its humid but cool highlands and warm but desert lowlands seem to be a challenging environment for tortoises. The tortoises need the heat to keep their metabolism high enough to properly digest their food, but the available food is in the highlands where it's too cool for proper metabolic functions. Thus wild Galapagos tortoises usually have to travel far between food and heat. Significantly, the largest animals are found on the island with heated mud pools from thermal activity high on Alcedo's caldera. Ray's slides gave a good overview of what the wild tortoises' habitat is like on the islands along with charming pictures of babies and young raised at the CDRS.



One of the carefully thought out Galapagos raising pens at the Brookfield Zoo.

Then he showed the pens developed to raise the hatchlings at Brookfield. Looking like a PVC pipedream, pictures of the set-ups allowed us to follow Ray's descriptions as he told us all the details that went into their construction. No ninety-degree corners and an ingenious t-shaped movable piece seemed to curb the animals from trapping and overturning each other. Heat lamps and UVB bulbs hung above and heat pads were placed under the tables. Soft, easily cleaned rubber substrate was inset with concrete patches to wear down nails and water bowls were sunken for easy exit and entry. Temperatures were closely controlled and monitored. Once the animals were large enough (about 2½ years old), they were kept outside during the warmer months. The keepers were surprised when the first group of seven tortoises denuded a heavily overgrown half-acre



Seven tortoises, ½ acre of natural vegetation, six weeks. From this . . .



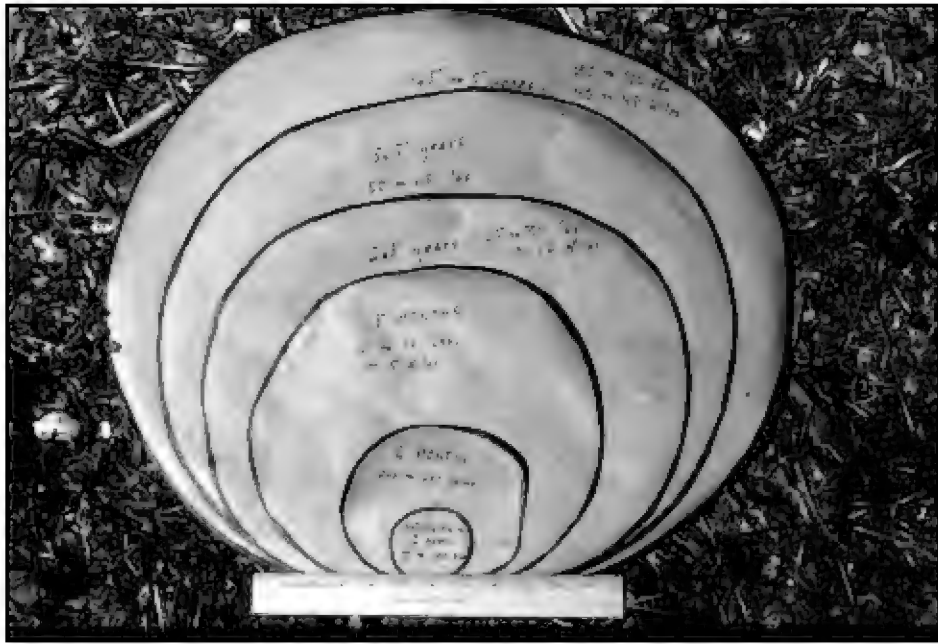
. . . to this. These creatures can eat!

in only six weeks, in spite of receiving their regular diet. The tortoises thrived and grew. In fact, they grew quite rapidly, certainly much faster than their wild cousins. Animals raised at the CDRS would weigh about 12 pounds after five years, while Brookfield's tortoises averaged 134 pounds!

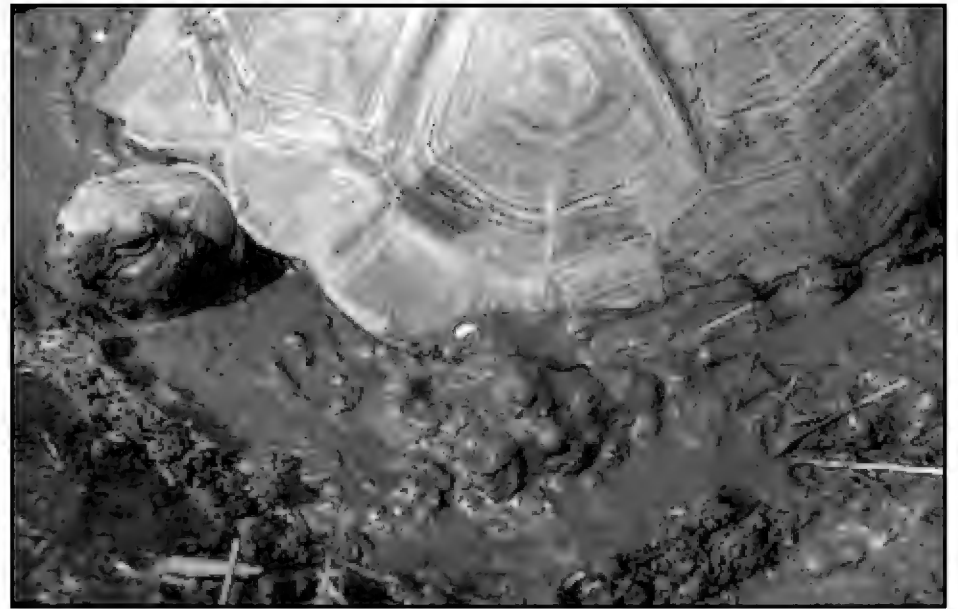
Ray went into the diet fed to the animal in good detail, explaining the amount and composition, and made a very good case that they weren't power feeding their animals. Unfortunately Ray left Brookfield before he could collect further data on growth and his successors did not carry on his studies. He challenged the audience to further his studies, using any of the larger tortoises. Ray thinks that perhaps the harsh environment of the Galapagos has restricted the wild tortoises' growth and



The obligatory cute baby tortoise picture. The food was spread so there was less chance of fighting.



A model showing the rapid growth of the Brookfield tortoises.



A happy tortoise is a tortoise in a mud wallow.

that when kept under optimum conditions, Galapagos tortoises might grow to even larger sizes than those on the inhospitable islands. He thinks that it's not genetics but environment that is growth limiting. He also proposed that pyramiding may be aggravated by too great a temperature differential between ambient heat and substrate heat. The only case of pyramiding at the zoo was an animal that had inadvertently been kept in a significantly warmer ambient temperature than the others and Ray said that animals that are kept on substrate too much warmer than ambient develop thicker than normal plastrons. And he thinks the growth rates in his tortoises indicate the possibility that captive tortoises aren't being fed enough. Ray gave us some interesting avenues for future inquiries by tortoise owners, especially those of you who work with the larger tortoises.

Ray ended his presentation with a lively question and answer session that revealed more interesting anecdotes. Brookfield saw their outdoor tortoises occasionally grab and eat ground squirrels! One tortoise would hover over its food, wait for a sparrow to hop underneath, then smash the bird and eat the carcass. The tortoises loved mud wallows, possibly because they were warmer than the pools of water. And they could eat about 25% of their body weight in a week.

It was a pleasure to listen to Ray Pawley, and certainly a pleasure to meet and converse with him and his wife. After a long time, I know why Ray Pawley's name is mentioned so often around the Chicago Herpetological Society. Now I'll have a chance to drop it myself every once in awhile.

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Herpetology 2010

In this column the editorial staff presents short abstracts of herpetological articles we have found of interest. This is not an attempt to summarize all of the research papers being published; it is an attempt to increase the reader's awareness of what herpetologists have been doing and publishing. The editor assumes full responsibility for any errors or misleading statements.

IGUANAS MAY HAVE WALKED TO FIJI

B. P. Noonan and J. W. Sites [2010, American Naturalist 175: 61-72] note that in 1947, when Thor Heyerdahl's Kon-Tiki hit ground in the Tuamotu Archipelago, 102 days and 4,000 km from its point of origin in South America, he inadvertently provided support for one of the most remarkable hypotheses of vertebrate dispersal. Iguanid lizards and boine snakes are ancient Gondwanan lineages whose distribution has been demonstrated to have been influenced by continental drift. Their enigmatic presence on the islands of the Pacific, however, has drawn fantastical conclusions of more than 8,000-km rafting from the Americas. The authors reexamine the hypothesis of dispersal in light of new molecular data and divergence time estimates. Results suggest an early Paleogene (50–60 million years) divergence of these groups and the plausibility of an Asiatic or Australian (over land) source. Because the subfossil record indicates that iguanas (but not snakes) were a primary food source of island inhabitants, the absence of these species from islands with a longer history of human presence is unsurprising. Together these findings are taken as evidence of the influence humans have had on these taxa and are put forth as an example of anthropogenic obfuscation of biogeographic history. The authors suggest that this history is one of terrestrial connections permitting the colonization of the islands of the Pacific.

BOG TURTLE HABITAT USE

S. E. Pittman and M. E. Dorcas [2009, Copeia 2009(4): 781-790] note that because many species of semi-aquatic turtles have specific habitat requirements and unique life history characteristics, they are particularly vulnerable to anthropogenic habitat modification. The federally threatened bog turtle (*Glyptemys muhlenbergii*) requires specialized wetland habitats, such as bogs and fens, in the eastern United States and often occurs in isolated populations. To develop a more detailed understanding of the habitat use, movement, and thermal biology of bog turtles, the authors radiotracked and monitored the temperatures of 11 adult bog turtles at an isolated Piedmont meadow bog in North Carolina from May 2007 to March 2008. They found that turtles used soft, shallow mud habitat in the bog, but moved to a streambed when the bog became dry. While in the bog, turtles were often found within or underneath woody debris. Although most turtles resided exclusively in the southern part of the bog and the stream, two male turtles made substantial overland movements away from the bog exceeding 130 m. All but one turtle overwintered in a streambed adjacent to the bog. Turtles overwintering within stream habitat were not exposed to temperatures below 0°C, but one turtle that overwintered in the bog did reach below-freezing temperatures. This study suggests that high-quality bog habitat and habitat heterogeneity are critical for populations living in isolated and dynamic habitats. However, maintenance of corridors between suitable habitats may be necessary for the long-term survival of bog turtle populations.

FOREST CANE TURTLE BIOLOGY

N. Whitaker and J. Vijaya [2009, Chelonian Conservation and Biology 8(2):109-115] conducted a 2-year study on the forest cane turtle, *Vijayachelys silvatica*, in Chalakudy District, Kerala, South India. This species, known to science from only 2 specimens until 1982, is endemic to the Western Ghats of Southern India. The aims of the study were to ascertain morphometrics, sex ratios, and reproductive data in the field. Female *Vijayachelys* were more massive than males and significantly larger in all the characters examined, except for straight-line carapace length. The sex ratio among adult individuals was 47 males to 36 females (1.31:1), which did not differ significantly from 1:1. The greatest number of turtles was found in October and the fewest in May. Mating was observed in the months of June, September, and November and oviposition in January and February. Clutch size was 2 eggs in most cases. Turtles were observed to feed on snails, mushrooms, centipedes, and beetles living in the molding leaf litter and humus. Almost all turtles had algae on their shells.

RELEASING REHABILITATED TORTOISES

K. Wimberger et al. [Chelonian Conservation and Biology 8(2): 173-184] report that Babcock's leopard tortoises (*Stigmochelys pardalis babcocki*) are taken to rehabilitation centers in KwaZulu-Natal province, South Africa, because they are either escaped, unwanted, or confiscated pets, or else are confiscated from persons who acquire them illegally from the wild. South African rehabilitation centers are reluctant to euthanize tortoises, and there are few tortoise sanctuaries. Consequently, the local conservation authority, Ezemvelo KwaZulu-Natal Wildlife, developed a release protocol based on International Union for Conservation of Nature and Natural Resources guidelines, to facilitate the release of rehabilitated *S. p. babcocki* into the wild. The present study was done to determine whether rehabilitated animals could be successfully released into the wild, judged by whether individuals were able to survive in the wild. Seventeen apparently healthy individuals with carapace lengths > 100 mm that had been in captivity for more than 2 months in a large rehabilitation center were released into the wild. These rehabilitated animals, with attached radiotelemeters, were hard-released at 2 different sites within the historical range of the species and were monitored over a year. One tortoise was returned to captivity because of disease, 3 were killed intentionally or accidentally by humans, one died probably due to being turned over by another animal, 3 others died from a combination of disease, starvation and/or dehydration, and the fates of 6 were unknown. Because only 2 animals survived 13 months after release at one of the sites and only one was known to have survived 25 months after release at the other site, rehabilitated *S. p. babcocki* were not successfully released into the wild. However, recommendations to improve the probability of success of future releases of rehabilitated *S. p. babcocki* into the wild are provided.

Unofficial Minutes of the CHS Board Meeting, January 15, 2010

The meeting was called to order at 7:39 P.M. at the Schaumburg Public Library. Board members Andy Malawy, Linda Malawy and Jenny Vollman were absent.

Officers' Reports

Recording Secretary: Cindy Rampacek read the minutes of the December 18 board meeting and minor corrections were made. The minutes were accepted.

Treasurer: In Andy Malawy's absence, Mike Dloogatch presented the final statement for the year.

Membership Secretary: Mike Dloogatch shared the expired memberships with the board. He also reported a substantial increase in membership for December. Some of the increase can be attributed to grant applications.

Corresponding Secretary: Deb Krohn reported there had been a problem with the phone messages, but everything seems to be working good now.

Publications Secretary: Aaron LaForge will soon have new meeting dates and board members on the website. A former member has offered to donate old Bulletins. Cindy offered to try to coordinate transport from Michigan. Aaron is still looking for someone to smooth out the digital version of our logo. Josh Hoppenrath has been volunteered.

Sergeant-at-arms: Dick Buchholz reported that there were 53 members present at the December general meeting / holiday party. John added that Donna Gustafsson from the Notebaert called and left John a message that she really wanted to help promote the CHS.

Committee Reports

Shows:

- Notebaert shows. January 2–3 went well; we had great staffing, and lots of folks coming by. Next dates February 6–7 and March 6–7.
- Hunting and fishing show, January 30, Rosemont Horizon
- Great Lakes Pet Expo, February 6, Milwaukee Wisconsin.
- Emily Oaks Nature Center, February 9
- NARBC, February 13–14.
- Chicagoland Kids Expo, February 20–21.
- Reptile Rampage, March 14.
- Chicagoland Family Pet Show, Arlington Park, March 19–21
- ReptileFest, April 10–11.

Adoptions: Linda was absent, but Bob Bavirsha shared that projecting photos of animals available for adoption at the December meeting went over well. Chris Carmichael took many snakes for his study of pheromone trailing by Burmese pythons.

Old Business

ReptileFest: Rick Hoppenrath has printed a ton of business cards promoting ReptileFest 2010. Mary has been doing a lot of leg work on advertising. They are trying to learn where we can get the best bang for our money. Rick feels it's billboards.

He is looking at digital billboards, which offer 900 views per day for the month prior to 'Fest. It offers better coverage than newsprint for a lower price. Rick is looking at more ways to reach out to the general public. Rick is also looking to get a group together for a planning meeting.

December meeting: John thanked Deb Krohn for taking charge of the refreshments and Bob Bavirsha for the slide show

New Business

Salmonella is an issue. Recently Serpent Safari was sued over this issue. We need to look at being more proactive to address the need to wash hands.

S373: Cindy, Jason and Aaron gave a few brief statements explaining it. John Archer hopes and strongly suggests we all take a moment to contact our representatives in the legislature.

Grants: Rick Hoppenrath made a motion to allocate \$5000.00 for the 2010 CHS grants program. A short discussion ensued. Aaron LaForge seconded the motion. The motion passed unanimously.

US Global Exotics confiscation: Lively discussion ensued. We will wait a bit to see what is happening and we may have the ability to help out further down the road. Right now the owners of US Global have appealed the transfer of ownership of the animals to the Texas SPCA.

Round Table

Jim Foster had a great time with Bob at the closing of the Animal Kingdom pet store, and it was a bit bittersweet.

Rick mentioned that he had received a call from the Worth Park District looking to add a reptile of the month program for school age kids. Rick is donating the proceeds to the CHS.

Nancy was happy to see Animal Kingdom closed.

Mark Erickson will be working on the CHS library's database and needs the password for the spreadsheet.

Dick inquired about the wrong date on the Yahoo! notification of the board meeting.

The meeting was adjourned at 9:40 P.M.

Respectfully submitted by recording secretary Cindy Rampacek



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Advertisements

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For sale: rats and mice—pinkies, fuzzies and adults. Quantity discounts. Please send a SASE for pricelist or call Bill Brant, *THE GOURMET RODENT*, 12921 SW 1st Rd, Ste 107-434, Jonesville, FL 32669, 352-472-9189, E-mail: GrmtRodent@aol.com.

For sale: from **The Mouse Factory**, producing superior quality, frozen feeder mice and rats. Our mice and rats are vacuum-packed to greatly extend freezer life by reducing freezer burning and preserving vitamin and nutrient content. We feed our colony a nutritionally balanced diet of rodent chow, formulated especially for us, and four types of natural whole grains and seeds. For a complete price list please visit our web site, www.themousefactory.com. We accept all major credit cards, PayPal or money orders. Call us **toll-free** (800) 720-0076 or send us an e-mail at info@themousefactory.com. Write us at PO Box 85, Alpine TX 79831.

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For sale: Rats—live or frozen. I breed rats for my collection of boas so only top quality lab chow and care will do, I'm now offering surplus animals for sale. Located in far south suburbs of Chicago. Only orders of 20 or more please, no large rats will be available. For current availability and prices, please e-mail Steve at smuys@sbcglobal.net.

For sale: books. *Mountains of Mystery* by Thomson, Hall and Friend, 1993, 189 pp., many b&w drawings, a natural history of the Stirling Range which is located in southwestern Western Australia, a world biological hotspot, contains sections on birds, mammals, reptiles and amphibians (8 pp.), invertebrates and plants, also discusses geology, landforms, history and management, \$40; *Thylacine: The Tragedy of the Tasmanian Tiger* by Eric Guiler, 1985, 207 pp., b&w photos and drawings, figures and tables, the history of the thylacine from fossils and early aboriginal paintings to the present day by this noted thylacine authority, an excellent copy of this very scarce work, DJ, (h), \$395; *Lizards of Western Australia—Vol. 1—Skinks*, 1981, 200 pp., 20 plates with 6–8 color photos each, drawings, range maps; keys, descriptions, derivations of scientific names, (s), \$38; *Lizards of Western Australia—Vol. 2—Dragons and Monitors*, 1983, 113 pp., 20 plates with 2–8 color photos each, drawings, range maps, keys, descriptions, derivations of scientific names, (s), \$38; *Snakes of Western Australia*, 1986, 187 pp., 24 plates with 1 to 8 color photos each, drawings, range maps, descriptions, distribution, derivations of scientific names, extensive bibliography, (s), \$38; all three of these books authored by G. M. Storr, L.A. Smith and R. E. Johnstone. All three for \$100. All books in excellent condition and sent postpaid in the U.S. Subject to prior sale. William R. Turner, 7395 S. Downing Circle W., Centennial, CO 80122. Telephone (303) 795-5128; e-mail: toursbyturner@aol.com

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Line ads in this publication are run free for CHS members — \$2 per line for nonmembers. Any ad may be refused at the discretion of the Editor. Submit ads to: Michael Dloogatch, 6048 N. Lawndale Avenue, Chicago IL 60659, (773) 588-0728 evening telephone, (312) 782-2868 fax, E-mail: MADadder0@aol.com

News and Announcements

2010 CHS GRANT RECIPIENTS

The CHS Grants Committee has chosen the CHS grant recipients for 2009. The committee consisted of Michael Dloogatch, Deb Krohn, Linda Malawy, Amy Sullivan and Steve Sullivan. This year we received 27 applications, as usual exceeding the number of grants that could be awarded based on available funds. After a difficult decision process, 7 grants were awarded, in varying amounts, as follows:

- Alecia Carter, The Fenner School of Environment and Society, Australian National University. "Testing Untested Assumptions of Behavioral Syndromes: Does the Asset Protection Principle Apply?" \$500.
- Grant Connette, Department of Biological Sciences, University of Missouri–Columbia. "A Mechanistic Examination of Salamander Declines in Response to Timber Harvesting," \$535.
- Reginald Theodor Mwaya, Department of Biological Sciences, Western Michigan University. "Effects of Human-induced Habitat Change on Populations of the East African Endemic Pancake Tortoise, *Malacochersus tornieri* (Family: Testudinidae), in Tanzania, East Africa," \$1000.
- Nicholas B. Pollock, Department of Biological Sciences, California Polytechnic State University. "Factors Influencing Ectoparasitism on Western Fence Lizards (*Sceloporus occidentalis*): Testosterone, Vitellogenesis and Health," \$500.
- Shahriar C. Rahman, Brooklyn College (undergraduate). "Evaluating the Effects of Nest Protectors for Turtle Conservation," \$500.
- Rory S. Telemeco, Department of Ecology, Evolution, and Organismal Biology, Iowa State University. "How Did Viviparity Evolve in Squamate Reptiles? An Experimental Test of the Maternal-manipulation Hypothesis," \$1000.
- Dan Zeh, Environmental Studies Department, Antioch University. "Natural History of Wood Turtle (*Glyptemys insculpta*) Populations in Southwestern New Hampshire and Recommendations for Conservation Management," \$963.90.

**The Chicago Herpetological Society presents**

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ReptileFest 2010
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Chicago Herpetological Society members are encouraged to exhibit.
More information at www.Reptilefest.com, or contact Rick Hoppenrath at 708-277-4082.

University of Illinois-Chicago, P.E. Building 901 W. Roosevelt Rd.
(One block west of Halsted), Chicago
Admission: Adults \$8.00 • Children (3-11) \$6.00

UPCOMING MEETINGS

The next meeting of the Chicago Herpetological Society will be held at 7:30 P.M., Wednesday, February 24, at the Peggy Notebaert Nature Museum, Cannon Drive and Fullerton Parkway, in Chicago. **Dr. Charles Knapp**, Director of Conservation and Research at the Shedd Aquarium, will speak about his work in the Caribbean with the critically endangered rock iguanas of the genus *Cyclura*.

At the March 31 meeting, **Dr. Paul Sereno**, a professor in the University of Chicago's Department of Organismal Biology and Anatomy and a world-famous paleontologist, will speak about some of his recent discoveries. You don't want to miss this one.

The regular monthly meetings of the Chicago Herpetological Society take place at Chicago's newest museum—the **Peggy Notebaert Nature Museum**. This beautiful building is at Fullerton Parkway and Cannon Drive, directly across Fullerton from the Lincoln Park Zoo. Meetings are held the last Wednesday of each month, from 7:30 P.M. through 9:30 P.M. Parking is free on Cannon Drive. A plethora of CTA buses stop nearby.

Board of Directors Meeting

Are you interested in how the decisions are made that determine how the Chicago Herpetological Society runs? And would you like to have input into those decisions? If so, mark your calendar for the next board meeting, to be held at 7:30 P.M., March 19, in the adult meeting room on the second floor of the Schaumburg Township District Library, 130 S. Roselle Road, Schaumburg.

The Chicago Turtle Club

The monthly meetings of the Chicago Turtle Club are informal; questions, children and animals are welcome. Meetings normally take place at the North Park Village Nature Center, 5801 N. Pulaski, in Chicago. Parking is free. For more info visit the CTC website: <http://www.geocities.com/~chicagoturtle>.

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